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TRANSLATION OF AN OFFICE ACTION FROM THE GERMAN PATENT AND TRADEMARK OFFICE

Applicant: UTC Fuel Cells, LLC
German Patent Application No.: 102 96 673.7-41
Dated: June 27, 2005
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Our ref.: K 60 307/8-St

Request for examination, date of payment Oct. 17, 2003.

The examination of the above-indicated patent application has led to the results set forth hereinafter.

A term of

4 month(s)

is granted for reply. This term begins on the date following the date of service of this office action.

Documents possibly attached to the response (e.g. specification, parts thereof, claims, drawings) must each be filed in duplicate and on separate sheets. The response proper is only required once.

If the specification, claims or drawings are amended in the course of the proceedings and the amendments have not been suggested by the German Patent and Trademark Office, the applicant is to state in detail where in the original documents the inventive features described in the new documents are disclosed.

In the present office action, the following references are mentioned for the first time (their current numbering will be used during the further examination proceedings):

- (1) US 5 360 679 A**
- (2) DE 197 41 331 A1**
- (3) DE 199 30 051 A1**
- (4) EP 0 924 161 A2**

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(5) WO 01/24922 A1

(6) DE 33 45 958 A1

(7) DE 41 93 026 T1

With the set of claims filed March 21, 2002 – claiming a priority of a US patent application of April 18, 2001 – and comprising 16 claims, the applicant seeks patent protection for a **fuel cell system** comprising among other things a re-former, a shift stage and a fuel cell, in which water is added to the reformed gas flow in purposeful manner in order to adjust the temperature of the hot reformed gas flow to a desired value, as well as for the **method** for controlling the temperature of the reformed gas flow in this fuel cell system.

The Examiner would like to point out first the following unclarities and deficiencies in the application papers:

- Claims 2 and 16: these claims are merely formulated as objects to be obtained and just point out **what** is to be achieved (... *the desired oxygen/carbon ratio for the shift converter...*), but do not give a technical teaching as to **how** this is to be or can be achieved. Claim 16 mentions furthermore the advantages of this object (... *minimizes excess steam injection into the fuel processor so as to improve efficiency of the power plant.*) For reasons of clarity in terms of law, apparatus claims should contain only concrete features in the characterizing part thereof, and method claims should contain only concrete measures containing a corresponding technical teaching. The described object as well as the advantages thereof are suited as statements in the description of a patent application. The Examiner recommends to the applicant to draft these claims in corresponding more concrete terms – in so far as these are disclosed sufficiently in the original application papers – or to otherwise delete the same.
- Fig. 1 as well as line 134 and line 150 (page 5/12): The description speaks of a conduit 16, but this numeral is not contained in any of the figures. In contrast thereto, Fig. 1 contains numeral 6 that is not elucidated anywhere. There is presumably just a typing error involved here, and numeral 6 in the figure should be numeral 16 explained in the description. Nevertheless, the

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two numerals 6 (or – if intended otherwise – 16) and 18 seem to designate one and the same conduit, without a reaction container being provided therebetween or without a different conversion being recognizable. However, two reference numerals for one and the same component of an apparatus are not admissible. The applicant is requested to mark the figure unequivocally and to elucidate the description without contradictions.

- Fig. 1: Analogously to numerals 32, 36 and 38, numeral 34 lacks the arrow to mark the location at which the gas conduit is connected to the water supply conduit. OK
- Units: The German Patent and Trademark Office permits patent applications with SI units only. The applicant is therefore requested to convert those units in the application that do not comply with this requirement into corresponding SI units. This holds for the units °F (at several locations in the description), lbs./h H₂O (line 188) and pph (lines 192 and 193). OK

In addition thereto, the Examiner points out the following orthographic errors in the claims:

- claim 1: ...zu mindestens einer der ersten oder zweiten Leitungseinrichtungen...
- claim 1: ...von mindestens einem ~~von~~ reformierten Gas ...
- claim 3: ... Wasserzuführeinrichtung .
- claim 6: ... zweiten Leistungseinrichtung
- claim 12: ... zu einem im Wesentlichen...
- claim 16: ... Steuern des ~~des~~ Einspritzens...
- claim 16: suggested version of the last subordinate clause: ...was die übermäßige Dampfeinspritzung in den Brennstoffaufbereiter minimiert und so die Effizienz ~~verbessern~~ der Stromerzeugungsanlage verbessert.

In case the application is prosecuted, the factual and linguistic deficiencies need to be eliminated. However, in the light of the prior art ascertained, this may be postponed for the time being.

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Reference (1) discloses a fuel cell system powered by hydrogen (produced by standard reforming with conversion and subsequent selective CO oxidation). Before the hydrogen formed is fed to the anode, it is directly subjected to water or quenched, cp. also numerals **166, 172, 176, 180, 40** in Fig. 1 along with the related text explanations in conjunction with claim 6.

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Reference (2) discloses a method of cooling a fuel cell, which also makes use of a quench-type cooler, cp. also the claims and figures thereof, in Fig. 1 in particular the humidifier **B2** arranged between conversion zone and anode of the fuel cell.

Reference (3) reveals the utilization of water quenching for an auto-thermal reforming process. The auto-thermal reforming step is followed by a conversion stage, with water quenching for cooling the reformed gas being applied downstream of the reformer or upstream of the conversion zone, cp. in particular in Fig. 3 numerals **10, 20** and **25a** as well as the claims.

In comparison with the prior art known from reference (1) or (2), the claimed subject matter according to claim 1 (second alternative) is not novel. In comparison with reference (3), the claimed subject matter according to claim 1 (first alternative) is not inventive. Corresponding findings apply analogously for the method according to claim 12.

In the light of the present situation, claims 1 and 12 fail to be allowable.

References (4) to (7) are cited as supplementary prior art. Reference (4) describes an apparatus for and a method of steam reforming a hydrocarbon to provide the hydrogen required for the fuel cells of a fuel-cell-operated motor vehicle, in which in a preferred embodiment water can be metered via at least one feed line upstream of the reforming reactor and/or upstream of the hydrogen separating stage and/or in the catalytic burner means in order to act as heat transport medium and at the same time avoid overheating (claim 6, Fig. 1, paras. [0017] and [0027]. Reference (5) describes an auto-thermal reforming reactor in which the auto-thermal reaction zone is followed by a quench zone in which the gas mixture from the reformer, upon passage of a heat shield, is

rapidly quenched to a lower temperature level by the addition of water (claim 1 and 2, page 6, para. 7 and page 7, para. 6). A subsequent shift stage does not find particular attention in any of these two documents, but reference (1) does mention the CO shift reaction as an alternative to the preferred hydrogen separating stage (para. [0002]), and reference (5) deems the installed heat shield to be advantageous for more uniform supply in a shift reaction effected downstream of a reactor (page 5, para. 4).

With deletion of claims 1 to 12, claims 2 to 11 and 13 to 16, respectively, dependent thereon also **fail to be allowable** as they do not contain something patentable of its own and as the embodiments described therein to a large part were already known from the prior art literature on the priority date. For example, the possibility of collecting and returning water from the fuel cell is already explicitly mentioned in reference (7), and the use of high surface area material – to obtain as efficient cooling as possible – is already known from reference (5) (page 7, para. 6). The drafting of claims 2 and 16 along the lines of a mere object to be obtained has already been pointed out.

Reference (6) describes a methanol reactor system in which steam from the anode effluent gas of a fuel cell stack is transported through a membrane to the reformed gas flow having a higher temperature, and is thus cooled and humidified by the reformed gas (page 9, para. 1).

Document (7) – as mentioned hereinbefore – describes the return of the water formed in the fuel cell to the reforming device and in doing so expressly emphasizes the excellent suitability of this pure water (page 18, para. 3).

On the basis of the documents on file, grant of a patent is not possible in the light of the situation outlined hereinbefore.

Examiner for Clas C 01 B
Dr. Koszinowski

Encs.: copies of references (1) to (7)